

tains chain. This crust-folding was followed by the deposition of plant-bearing Tertiary strata. The Raton Mesa region is rich in coal-bearing beds containing a large number of flowering plants, with a few twigs of conifers and fragments of sterile fern-fronds. The flowering plants are, unfortunately, represented almost exclusively by detached leaves.

Different views have been held on the geological age of these sediments. Lesquereux referred them to the Tertiary period, and later geologists regarded them as Cretaceous. The evidence now brought forward points to the occurrence of two distinct formations, the Vermejo formation below separated by a well-marked unconformity from the overlying Raton formation. It is believed that this unconformity marks the boundary between the Cretaceous and Tertiary systems in Colorado and New Mexico. In the interval represented by the unconformity there was widespread erosion of the uplifted floor of the Cretaceous sea before the deposition of the Lower Tertiary Raton formation.

From a geological point of view the conclusions based on a considerable mass of information are of great interest as a contribution towards a more precise determination of the Cretaceous-Tertiary boundary. Both the Vermejo and Raton formations are rich in fossil plants, Dicotyledons being the most abundant in each flora; the Vermejo flora is correlated with the Montana flora, while the Raton flora is believed to be Eocene. A noteworthy feature of the Raton flora is the inclusion of some exceptionally fine specimens of palm-leaves, but, as Mr. Knowlton states, it is impossible to refer most of them to a definite position on leaf-characters only.

The palæobotanical portion of the volume is well illustrated and the specimens are concisely described. It is, however, unfortunate that little attempt is made to compare the plants with species other than American. The application of the names of recent genera to many of the specimens, though in accordance with a common practice, suggests a lack of appreciation of the difficulties of systematic work when leaves only are available. In many cases it is clearly impossible to accept the generic determinations of both fern fragments and dicotyledonous leaves without hesitation.

Mr. Knowlton has done good service by rendering available much new material, and the excellent illustrations will enable students of palæogeography to institute comparisons between the American and other types. The absence of conifers in the Raton flora as contrasted with their comparative abundance in the older Vermejo flora is an interesting feature, though it is scarcely safe to assume, as Mr. Knowlton does, that the group was unrepresented in the contemporary vegetation of the district.

The greater part of the volume is devoted to Mr. Lee's extended researches, which include the results of field work in many districts and a very useful correlation of the formations in the Raton Mesa region with those in other parts of the continent.

The investigation of the later Cretaceous and earlier Tertiary floras has acquired a fresh importance in view of the recent work of Mrs. Reid, who is ably carrying on the researches initiated by the late Mr. Clement Reid on the younger Tertiary floras. The recognition of many Chinese types of flowering plants in the Pliocene beds of western Europe, as Mrs. Reid has shown, throws light on the interrelationships of floras that are now widely separated. A critical analysis of the older Tertiary floras in both the Old and the New World should enable us to obtain a deeper insight into the early history of the Angiosperms. One of the difficulties in the way of a comprehensive survey of fossil floras is that of correlation, and it is only by the co-operation of stratigraphical geologists and palæobotanists that this difficulty can be met. American investigators have realised the importance of such collaboration, and their example might with advantage be followed more closely in this country. It may be said that if the accurate determination of fossil leaves, especially those of Angiosperms, is impossible, why attempt it? The answer is that palæobotanists do not, as a rule, sufficiently avail themselves of the assistance of experienced systematists, and are too ready to be satisfied with resemblances based upon characters which are common to several recent genera. Though many fossil leaves referred to recent genera are valueless as accurate data, this is no reason for assuming that greater accuracy in the analyses of floras is unattainable.

Isle of Wight Disease in Hive Bees.¹

By DR. A. D. IMMS.

ISLE OF WIGHT disease is the most serious menace to apiculture in Great Britain. The prevalence of this complaint and the present high cost of bee appliances and of stocks render it extremely doubtful whether any profit can be derived from the keeping of bees solely for honey production. Many bee-keepers find it more profitable to supply bees and queens, together with the necessary apparatus, and hundreds who take up bee-keeping relinquish it after a short time as being non-productive.

The disease has continued without interruption from about the year 1902 until the present time, and no epidemic of an equally permanent and extensive nature has so far been indisputably recognised outside the British Isles. The first preliminary investigation

into its cause was carried out in the Isle of Wight in 1907 by the present writer, who described many of its symptoms, but was unable to discover any protozoa connected with it. In 1912 and 1913 Graham Smith and others put forward the theory that it was due to *Nosema apis*. More recent work by Anderson and Rennie and by Rennie and Harvey indicates that Isle of Wight disease and disease due to *Nosema* are two distinct complaints exhibiting different symptoms and pathological conditions.

In the first of the papers under review the causal organism of Isle of Wight disease is definitely stated to be a new species of mite, *Tarsonemus Woodi*. This Acarine was found in every one of 110 stocks reported by trustworthy bee-keepers, or certified by the investigators themselves, as suffering from Isle of Wight disease. The investigation involved an examination individually of at least 700 bees, and it was discovered that in every instance where symptoms of Isle of Wight disease were evident the mite was also present. No exception has been found. The parasite occupies

¹ "Isle of Wight Disease in Hive Bees." (1) "The Etiology of the Disease." By Dr. J. Rennie, P. B. White, and Elsie J. Harvey (pp. 739-54). (2) "The Pathology of Isle of Wight Disease in Hive Bees." By P. B. White (pp. 756-64). (3) "Isle of Wight Disease in Hive Bees—Experiments on Infection with *Tarsonemus Woodi*, n.sp." By Elsie J. Harvey (pp. 765-67). (4) "Isle of Wight Disease in Hive Bees—Acarine Disease: The Organism Associated with the Disease—*Tarsonemus Woodi*, n.sp." By Dr. J. Rennie (pp. 768-79, pl. 1, fig. 2). Trans. Royal Soc. Edinburgh, vol. lli., part iv., No. 29, 1921.

a very restricted region of the insect, being confined to the respiratory system, and only to those tracheæ which are associated with the anterior pair of spiracles. All stages of the Acarine were met with—eggs, larvæ, and adults; they occur within the tracheal tubes extending from the spiracles inwards. The tracheæ become darkened and ultimately black by the increasing deposition of chitin.

In studying the pathology of the disease Mr. P. B. White points out that the mites perforate the tracheæ and live upon the body fluids of their hosts, and he also raises the question, which is extremely difficult to answer, whether they exercise any toxic action also. When present in large numbers they entail the obstruction of the respiratory system of the head and thorax, thereby reducing the efficiency of the respiratory exchange of the organs supplied. In order to obtain some idea of the effects actually arising from the mechanical obstruction of the spiracles, a series of experiments was carried out upon healthy bees. The first spiracle of one or both sides of each bee was closed by means of melted paraffin-wax. Upon closure of one spiracle the experimental bees at once lost the power of flight, but otherwise remained active in their movements. After a lapse of several days the bees became more sluggish, and about the sixth or seventh day examples were noted with dislocated wings and other features which commonly accompany Isle of Wight disease. The thoracic musculature in many cases exhibited atrophy of the same type as had been found in bees infected with the Tarsonemus. In those experiments in which the first spiracle of each side was closed the power of flight was at once lost as before, but after twenty-four to forty-eight hours the bees developed a reeling gait and appeared to be continually falling over their own heads. It was seldom that any survived the third day.

As Mr. White points out, though too close a parallel must not be drawn with the natural disease, these experiments give a basis to the view that the rôle of the Tarsonemus in partially preventing thoracic respiration is of prime importance in the disease, possibly in itself capable of occasioning all the symptoms by which we are wont to diagnose the disease and the muscle atrophy so often associated with it.

There is evidently much still to be discovered; we know as yet very little concerning the migratory stage of the parasites, and provisional experiments in producing artificial infection have so far yielded inconclusive results. The reason for the parasite selecting the first pair of spiracles as its sole means of entry also needs elucidation. The authors of these researches are to be congratulated upon their discoveries, and it is quite evident that the whole subject of bee diseases is the most pressing problem in apiculture in this country to-day; in fact, the future of bee-keeping is dependent upon their thorough investigation.

University and Educational Intelligence.

CAMBRIDGE.—Prof. F. G. Hopkins has been elected to the Sir William Dunn professorship of biochemistry.

Sir Napier Shaw will give the Rede lecture on June 9 on the subject of "The Air and its Ways."

Mr. H. G. Carter has been appointed curator of the herbarium.

It is proposed to make a grant of 75*l.* from the Worts Fund to Prof. Seward towards defraying the

expenses of an expedition to Greenland undertaken by Mr. R. E. Holthurn and himself for the purpose of collecting fossil plants from Cretaceous and Tertiary rocks on Disco Island and the mainland and of studying the recent vegetation.

Steps are being taken towards an agreed solution at an early date of the problem of the position of women in the University. It is already clear, however, that the latest proposal will not be acceptable to a considerable section of University opinion, though it may carry with it moderate opinion, and also secure the support of those who voted in December for Report A.

LONDON.—The following public lectures will be delivered at King's College during the Easter term. Admission to public lectures is free and without ticket, except when otherwise stated:—A course of three lectures on Wednesdays, May 18 and 25 and June 1, at 5.30 p.m., by Prof. A. P. Newton, on "The Universities of the Dominions and the United States of America."

In the department of science a lecture or lectures will be delivered by Prof. Einstein early in May. The date and title will be announced later.

A course of four lectures on Tuesdays, May 3, 10, 17, and 24, at 5 p.m., by Mr. J. H. Jeans, secretary of the Royal Society, on "Cosmogony and Stellar Evolution."

In the department of philosophy a course of four lectures on Tuesdays, May 10, 17, 24, and 31, at 5.30 p.m., on "The Present Issue between Realism and Idealism," by Prof. H. Wildon Carr.

In the department of engineering a course of four special lectures for post-graduate and other advanced students on Tuesdays, beginning May 3, at 5.30 p.m., on "Cascade Work in Induction Motors," by Mr. L. J. Hunt. This course is free only to the regular students of the faculty of engineering.

A HOLIDAY course in geology will be held at the School of Metalliferous Mining, Camborne, Cornwall, on July 18–August 27. The course will deal with economic geology, with special reference to West Cornwall, and will consist of lectures and laboratory and field work. The programme includes the mapping of areas both on the surface and underground, a number of excursions to localities around Camborne of interest to geologists, and work in the school dealing with rock-forming minerals, rocks, the mechanical analysis of alluvial sands, and methods of dressing the products. Students wishing to enter for it should apply to the Registrar, School of Metalliferous Mining, Camborne.

It is announced that Prof. E. Cohen, of Utrecht, will give two lectures on "Metastability of Matter and its Bearings on Chemistry and Physics," probably at University College, London, on May 10 and 12 at 5.30 p.m. Two lectures by Prof. H. E. Armstrong on "Enzymes in Relation to Plant Growth" have also been provisionally arranged; they will be delivered at King's College on June 3 and 10 at 5 p.m. Another course, of three lectures, by Prof. E. W. MacBride, on "Recent Advances in Experimental Embryology," will probably be given at the Imperial College of Science and Technology on June 7, 8, and 9 at 5 p.m. These courses of lectures are intended for advanced students of chemistry, agriculture, and zoology respectively and others interested in these subjects. In all cases admission will be free and without ticket.